FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: **112740-282**

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR): **09/913412**

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/00450	**17 February 2000**	**18 February 1999**

TITLE OF INVENTION
SIGNALING POINT

APPLICANT(S) FOR DO/EO/US
Klaus David Gradischnig

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☒ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

Return Receipt Postcard.

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/913912	PCT/DE00/00450	112740-282

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

	CALCULATIONS PTO USE ONLY
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1,000.00**	
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO **$860.00**	
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$710.00**	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$690.00**	
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**	
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$860.00**
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	7 - 20 =	0	x $18.00	**$0.00**
Independent claims	1 - 3 =	0	x $80.00	**$0.00**
Multiple Dependent Claims **(check if applicable)**.			☐	**$0.00**
TOTAL OF ABOVE CALCULATIONS			=	**$860.00**
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**.			☐	**$0.00**
SUBTOTAL			=	**$860.00**
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	**$0.00**
TOTAL NATIONAL FEE			=	**$860.00**
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☒	**$40.00**
TOTAL FEES ENCLOSED			=	**$900.00**
			Amount to be: refunded	$
			charged	$

☒ A check in the amount of **$900.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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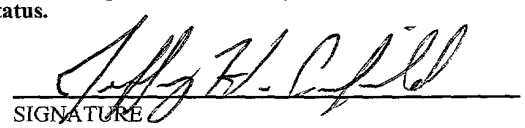

SIGNATURE

Jeffrey H. Canfield
NAME

38,404
REGISTRATION NUMBER

August 20, 2001
DATE

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE

OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANTS: Klaus David Gradischnig DOCKET NO: 112740-282

SERIAL NO.: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE00/00450

INTERNATIONAL FILING DATE: 17 February 2000

INVENTION: **SIGNALING POINT**

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In the Specification:

Please replace the Specification of the present application, including the Abstract, with the following Substitute Specification:

SPECIFICATION

TITLE

"SIGNALING POINT"

BACKGROUND OF THE INVENTION

In SS7 networks according to ANSI T1.111-1996, messages are distributed to the links of a link set (possibly also to the link sets of a so-called combined link set) by means of an 8-bit signaling link selection value (SLS) value. In older versions of the T1.111 standard (e.g. T1.111 - 1991), however, only 5-bit SLS

values are specified. In ANSI SS7 networks both methods must be compatible with one another (e.g. in the North American SS7 network) over what may be an extended period of time. Therefore, both methods use the same message format (figure 1a and 1b). In the older version, three bits are considered as being reserved and are therefore set to zero.

In this context, two problems arise: a) how does a signaling point using only 5-bit SLS values behave when it receives a message with an 8-bit SLS value; and b) how does a signaling point using 8-bit SLS values behave when it receives a message with a 5-bit SLS value. The particular problem that arises is that when such messages are forwarded from the signaling point, they are distributed as uniformly as possible to the links of a link set in spite of the short SLS value. An associated problem that also arises is how does the signaling point detect that the messages are only using a 5-bit SLS value. It is not possible to distinguish between a message having a short 5 bit SLS value and one in which, although 8 bits are used, the three extra bits happen to be zero.

With respect to a possible solution for the problem of determining how a signaling point using 8-bit SLS values behaves when it receives a message with a 5-bit SLS value, attention must be paid to the fact that the MTP guarantees with a high probability (see Q. 706) that messages having the same routing label (i.e. OPC, DPC and SLS) reach the destination in the same order in which they were sent. This is ensured by the fact that these messages are sent through the SS7 network via identical paths including identical link sets. However, it follows that a distribution of messages to the link sets or links must take into account this requirement. In the prior art and implementations corresponding to these

requirements, this is achieved by, among other things, sending all messages having the same SLS value and which are routed via a particular link set over the same link. In particular, a random or perhaps load-dependent distribution of the messages to the links is generally not allowed.

Until now, only one solution to the first problem of determining how a signalling point using only 5-bit SLS values behaves when it receives a message with an 8-bit SLS value is provided in the literature (see e.g. Bellcore GR-606-CORE, 1996). This indicates that signaling points which only use 5-bit SLS values are required to set the remaining three bits to zero when a message is generated and to ignore the remaining 3-bits on reception. This is the normal method of establishing compatibility in SS7 networks.

A possible solution for the second problem, that of determining the behavior of an 8-bit SLS signaling point when it receives messages having 5-bit SLS values, is to find a distribution of the SLS values to the links of a link set that is as uniform as possible independently of whether the SLS values used have a length of 5 bits or 8 bits. Distributions having such a property can be found but it is not clear whether they can also be established after link failures or link restorations without creating displacements of traffic streams defined by SLS values which are actually not necessary. In addition, methods for calculating such special distributions would be relatively complex.

Another possible solution for the second problem of determining the behavior of an 8-bit SLS signaling point when it receives messages having 5-bit SLS values is to define two distributions of the SLS values for each case. The first distribution for messages with 5-bit SLS values and the second one for messages

with 8-bit SLS values. Apart from the greater complexity of dealing with two different distributions for each case, this solution gives rise to the problem of how the signaling point is to determine that messages are using a 5-bit SLS value versus an 8-vit SLS value since it is not possible to distinguish between a message with a 5-bit SLS value and one in which, although and 8 bit SLS values is used, the three extra bits are zero. If messages originate from directly adjacent signaling points, a determination that 5-bit SLS values are being used can be established by simple administrative measures. However, if the messages come from anywhere in the SS7 network, administration of this information becomes expensive.

Both of the above described solutions also have the disadvantage that the load distribution of the messages having 5-bit SLS values is not improved and is generally worse in that it is more nonuniform than the load distribution of messages having 8-bit SLS values.

Furthermore, it must also be noted that an advantage of using 8-bit SLS values over 5-bit SLS values is that 8-bit SLS values make it possible to use up to 16 links in each D link set, i.e. in those link sets which connect two STP pairs with one another (see e.g. ANSI T1.111-1996, chapter T1.111.5, page T1.111.5-7, figure 4A/T1.111.5). When 5-bit SLS values are used, only up to 8 links have been used in one D link set.

The present invention further relates to a method of achieving uniformity of the load distribution to the individual links of a link set in the MTP of the ZGS7. Among other things, Uniformity of the load distribution is required in order to prevent link-set-related congestion control methods which are used in the MTP

from impeding or rendering impossible the higher utilization of the capacity of the other links when the link with the greatest loading triggers such controls.

Hitherto, the 4 bits (according to ITU) or 5 or 8 bits (according to ANSI) of the signaling link selection (SLS) field have been used for load distribution. Both ITU and ANSI assume that the possible SLS values are statistically (approximately) uniformly distributed. Such uniform distribution must be ensured by the users of the MTP. In the case of the ITU, this provides for a distribution of the total traffic into sixteen parts. Thus, for example, it can be easily seen in a link set with 5 links that when traffic is otherwise the same, the link with the greatest loading will be loaded as much as the link with the greatest loading in a link set having only 4 links. Thus, the link set with 5 links will thus have no higher capacity than a link set having only 4 usable links. The ANSI solutions with an SLS length of 5 or 8 bits, respectively, have considerable advantages, but cannot be used in ITU-oriented MTP networks because of the different message formats and can only be used if the entire MTP network affected (including all implementations of the MTP and its users) are converted, which, in practice, is not possible.

SUMMARY OF THE INVENTION

The present invention is related to a signaling point for use in a signaling network. The signaling point is provided for processing messages, including the function of receiving messages and forwarding the received messages to other signaling points. The messages processed by the signaling point include a Signaling Link Selection (SLS) field for determining the next signaling point to which a received message is to be forwarded. The signaling point uses the value store in the SLS field to identify the particular link by which the message is to be

forwarded. According to an embodiment of the invention, the signaling point employs all of the bits of the SLS field, whereas other signaling points within the signaling network may use only a subset for example only 5-bits, of the total bits that make up the SLS field. The signaling point of the present invention is configured to receive a message to be forwarded and establish an SLS value, and thereby determine the link by which the message will be forwarded. The signaling point establishes the SLS value of the message to be forwarded by taking the subset of bits of the SLS field of the received message and generating additional bits, preferably 3, by implementing a predefined function. In an embodiment of the invention, the functions employed by signaling point uses an originating point code (OPC) and/or a destination point code (DPC) for generating the additional bits of the SLS value. Further, the function may depend on the position of the signaling point within the signaling network, and the numbering strategy of the load distribution.

According to the present invention, the Message Transfer Protocol (MTP) of the signaling point distributes the SLS values to the links of a link set on the basis of a correlation that is selected in a manner such that the distribution among the links is as equivalent as possible, independently of whether the SLS value generated by the user includes all the bits of the SLS field or only the subset of bits of the SLS field. Further, the signaling point detects which messages have SLS values including all bits of the SLS field and which messages have SLS values including only a subset of the bits of the SLS field on the basis of administrative data corresponding to the link by which the message arrived.

Further according to an embodiment of the invention, the function employed by the signaling point for generating the additional bits of the SLS value uses bits from the SLS field of the received message which are not part of the subset of SLS field bits employed by other signaling points within the signaling network. The function is selected such that with a statistical independence of the remaining bits of the received SLS value and of the received OPC and DPC values, the remaining bits of SLS value generated by the function vary in at least the same degree in the messages sent as in the messages received.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1A shows message format having a 5-bit SLS field;

Fig. 2A shows a message format having an 8-bit SLS field;

Fig. 3 shows the operation of a function for generating the 3 additional bits for the SLS field, including and exclusive or operation on the three least significant bits of the OPC and DPC;

Fig. 4 shows the operation of a function for generating the 3 additional bits for the SLS field, including an exclusive or operation on the 3 least significant bits of the OPC and DPC as well as the 3 most significant bits of the SLS field of the received message.

DETAILED DESCRIPTION OF THE INVENTION

The present invention solves the problem of determining the behavior of an 8-bit SLS signaling point when it receives messages having 5-bit SLS values by expanding the 5-bit SLS value to 8 bits by supplementing the missing three bits. For this purpose, additional information contained in the messages, for example, address fields such as the originating point code (OPC) and, the destination point

code (DPC) are used in conjunction with a function to generate three additional bits which are used for expanding the SLS field (see fig. 2).

Functions for generating the additional 3 SLS bits based on OPC and/or DPC have the advantage that they can be applied to all MTP messages independently of the respective MTP user. The function used can depend, for example, on the position of the respective node in the MTP network, on the numbering strategy used by the MTP network operator, or on the desired granularity of the load distribution.

Furthermore, it can be an advantage to use the three most significant bits of the SLS field which may not have been set in the incoming message in addition to the OPC and DPC as parameters for the function generating the three additional bits of the 8 bit SLS value. This has the advantage that when a suitable function is selected, it is not necessary to determine whether these three bits were set in the incoming message. If they were not set, they have no influence. If they were set, they can increase the variability of the three additional bits that are generated.

It must be noted that this method could also be advantageously combined with the above-mentioned first possible solution for the problem of determining the behavior of an 8-bit SLS signaling point when it receives messages having 5-bit SLS values, namely, finding a distribution of the SLS values to the links of a link set that is as uniform as possible, independent of whether the SLS values used have a length of 5-bits or 8-bits. This has the advantage that the effect of any unbalanced distributions are then minimized.

According to the method of the present invention, the quality of the load distribution of messages having 5-bit SLS values essentially corresponds to that of

messages having 8-bit SLS values. Further, all messages coming from an STP equipped with this function use 8-bit SLS values. If the function is used sufficiently widely in an SS7 network, administration of whether a signaling point is using 5-bit or 8-bit SLS values becomes necessary only for nodes connected directly to an STP. Finally, an additional advantage is that no problems arise even if the administration data are not up to date (i.e. if nodes from which messages originate are still identified as 5-bit SLS nodes even though they are already using 8-bit SLS values) or if administration is dispensed with altogether. For instance, after introduction of the method according to the invention after which it would be assumed generally that 8-bit SLS values are used. This follows because only the extra three bits are changed by the present invention and their distribution thus becomes better, at most, with a suitable choice of function, while the advantageous 8-bit load distribution is used.

According to the present invention it becomes possible to expand messages having only 5-bit SLS values, which are received in signaling points with STP functions, to 8-bit SLS values.

One possible execution of the function for generating the additional 3-bits to convert 5-bits SLS values to 8-bit SLS values is to implement an exclusive OR operation on the three least significant bits of OPC and DPC and the insertion of the result into the SLS field of the relevant messages (see figure 3). The exclusive OR operation makes the variability of the function independent of whether it takes place close to the destination (greater variability of the OPC) or close to the origin (greater variability of the DPC).

Additionally, the three bits generated from OPC and DPC may also be logically combined with the three bits of the SLS field of the received message , which may not have been set. Again this logical combination may be accomplished by means of an XOR function (see figure 4). A special characteristic of the XOR operation described is that when the received three bits have already been set, and thus vary in the received messages, the three bits determined by the function vary by at least the same amount as the messages sent.

In addition to the SLS field, the present invention also uses the address fields originating point code (OPC) and, respectively, destination point code (DPC) of the MTP messages for load distribution. A function generates from the OPC and/or DPC a number of additional bits which, together with the SLS field, are used for load distribution. The function used can depend on the position of the respective node in the MTP network, on the numbering strategy used by the MTP network operator, or additionally on the granularity of the desired load distribution.

Improvement of the load distribution can be achieved locally, where required for example in a single node such as a signaling transfer point (STP), without interworking or compatibility problems and without expenses for changes for the MTP users, by using pre-existing information (i.e. the address information) which has the necessary variability with the exception of purely associated traffic relations. Another important step lies in the possible combination of OPC and DPC for increasing the variability of the assumed values.

One possible way of implementing the function for example is, to perform the exclusive OR operation on the two least significant bits of OPC and DPC. In the ideal case, this results in a granularity of the load distribution of 64ths. The

exclusive OR operation makes the variability of the function independent of whether it occurs close to the destination (greater variability of the OPC) or close to the origin (greater variability of the DPC).

CLAIMS

In the Claims

1. A signaling point in a signaling network for processing messages, including forwarding messages having an address field which is used by the signaling point to determine the next signaling point to which the message is to be forwarded, and an SLS field which is used by the signaling point to determine the links via which the signaling point forwards the message to the next signaling point, the SLS field exhibiting a particular number of bits and the signaling point using all bits of the SLS field for selecting said links, whereas other signaling points in the signaling network only use a particular subset of the SLS bits for selecting said links, the signaling point being configured to receive a message to be forwarded, and establishes an SLS value, and thus the link via which the message will be forwarded, wherein the SLS value for the message to be forwarded is established by taking over the particular subset of bits that form the SLS field of the received message for the SLS field to be sent and generating the remaining bits of the SLS field of the message to be forwarded by implementing a function.

2. The signaling point as claimed in claim 1, wherein said function uses an originating point code (OPC) and/or a destination point code (DPC) for generating said remaining bits.

3. The signaling point as claimed in claims 1 or 2, wherein the function depends on the position of the respective signaling point in the signaling

network, on the numbering strategy used in the signaling network operator, or on the desired granularity of the load distribution.

4. The signaling point as claimed in one of claims 1 to 3, wherein the MTP of the signaling point distributes the SLS values generated by a user of the MTP to the links of a link set on the basis of a correlation selected in a manner such that the distribution is as equivalent as possible independently of whether the SLS value generated by the user includes all bits of the SLS field or only the said subset of bits of the SLS field.

5. The signaling point as claimed in one of claims 1 to 4, wherein the signaling point detects messages having SLS values including only the subset of bits of the SLS field on the basis of corresponding administrative data at the link via which it arrives, and employs said function with said detected messages.

6. The signaling node as claimed in one of claims 2 to 5, wherein said function additionally uses the bits of the received SLS field which are not contained in the particular subset for generating the remaining bits of the SLS field to be sent.

7. The signaling node as claimed in claim 6, wherein said function is selected in a manner such that, with a statistical independence of the remaining bits of the received SLS value and of the received OPC and DPC values, the generated

remaining bits of the SLS field vary in at least the same degree the messages sent as in the messages received.

Abstract

The present invention solves the problem of determining how a signaling point using 8-bit SLS values behave when it receives a message with a 5-bit SLS value. In the case of messages using only 5-bit SLS values, the signaling point expands the SLS value to 8 bits by employing function that generates, for example, from the OPC and/or DPC, additional bits which are used for expanding the SLS field.

4 pgs

Description

Signaling point

1. What is the technical problem which is to be solved by your invention?

2. How has this problem been solved previously?

3. In what manner does your invention solve the technical problem specified (indicate advantages)?

4. What does an inventive step consists of?

5. Exemplary embodiment(s) of the invention.

1. In SS7 networks according to ANSI T1.111-1996, the messages are distributed to the links of a link set (possibly also to the link sets of a so-called combined link set) by means of an 8-bit SLS value. In older versions of the T1.111 standard (e.g. T1.111 - 1991), only 5-bit SLS values are specified. Both methods must cooperate with one another in ANSI SS7 networks (e.g. in the North American SS7 network) over a period of time which may be long. Both methods also use the same message format (figure 1a and 1b), in which three bits are considered as being reserved and are, therefore, set to zero in the older version.

In this context, two problems arise:

a) how does a signaling point using only 5-bit SLS values behave when it receives a message with an 8-bit SLS value; and

b) how does a signaling point using 8-bit SLS values behave when it receives a message with a 5-bit SLS value. The particular problem arising is that when such messages are forwarded in this signaling point, they are distributed as uniformly as possible to the links

of a link set in spite of the short SLS value. However, an associated problem is also how the signaling point can detect that these messages only use a 5-bit SLS value since it is not possible to distinguish between such a message and one in which, although the 8 bits are used, the three extra bits happen to be zero.

The subject matter of the present invention is an advantageous solution of problem b).

With respect to the possible solutions for b), attention must be paid to the fact that the MTP guarantees with a high probability (see Q. 706) that messages having the same routing label (i.e. OPC, DPC and SLS) reach the destination in the same order in which they have been sent. This is ensured by the fact that these messages are sent through the SS7 network via identical paths including identical link sets. However, from this it follows that a distribution of messages to the link sets or links must take into account this requirement. In the prior art and implementations corresponding to the requirements, this is achieved by, among other things, all messages having the same SLS value which are routed via a particular link set being sent over the same link. In particular, a random or perhaps load-dependent distribution of the messages to the links is generally not allowed.

2. Until now, only one solution to the first problem (a) is known in the literature (e.g. Bellcore GR-606-CORE, 1996). This indicates that signaling points which only use 5-bit SLS values have to set the remaining three bits to zero when a message is generated and to ignore them on reception. This is the normal method of establishing compatibility in SS7 networks.

A possible solution for the second problem (b) is to find **such** a distribution of the SLS values to the links of a link set **that** the distribution is as uniform as possible independently of whether the SLS values used have a length of 5 bits or of 8 bits. Distributions having such a property can be found but it is not clear whether they can also be established after link failures or link restorations without creating displacements of traffic streams defined by SLS values, which are actually not necessary. In addition, methods for calculating such special distributions would be relatively complex.

Another possible solution for the second problem (b) is to define in each case two distributions of the SLS values, one for messages with 5-bit SLS values and another one for messages with 8-bit SLS values. Apart from the greater complexity of dealing with two distributions in each case, the problem arises here of how the signaling point can detect that these messages are only using a 5-bit SLS value, since it is not possible to distinguish between such a message and one in which, although the 8 bits are used, the three extra bits are zero. If these messages originate from directly adjacent signaling points, this can still be established by simple administrative measures. If, however, these messages can come from anywhere in the SS7 network, administration of this information becomes expensive.

Both solutions also have the disadvantage that the load distribution of the messages having 5-bit SLS values is not improved and is generally worse, i.e. more nonuniform, than that of messages having 8-bit SLS values. Furthermore, it must also be noted that it is one of the advantages of using 8-bit SLS values to make it possible to use up to 16 links in each D link set, i.e. in those link sets which connect two STP pairs

with one another (see e.g. ANSI T1.111-1996, chapter T1.111.5, page T1.111.5-7, figure 4A/T1.111.5). When 5-bit SLS values are used, only up to 8 links have been used in one D link set.

3. The present invention solves the second problem in that, in the case of messages using only 5-bit SLS values, it expands the SLS value to 8 bits by supplementing the missing three bits. For this purpose, additional information contained in the messages (e.g. address fields (OPC - originating point code and, respectively, DPC - destination point code - see attachment) are used in that a function generates, e.g. from the OPC and/or DPC, three additional bits which are used for expanding **the SLS field** (see fig. 2).

Functions based on OPC and/or DPC have the advantage that they can be applied to all MTP messages independently of the respective MTP user. The function used can depend e.g. on the position of the respective node in the MTP network, on the numbering strategy used by the MTP network operator, or also on the granularity of the load distribution desired by him.

Furthermore, it can be of advantage to use for the function generating the three additional bits not only OPC and DPC as parameters but also the three (most significant) bits of the SLS field which may not have been set in the incoming message. With a suitable function, this has the advantage that it is no longer necessary to know whether these three bits are set in the incoming message. If they are not set, they do not have any influence. If they are set, they can increase the variability of the three bits generated.

It must be noted that this method could also be advantageously combined with the above-mentioned first possible solution for the second problem since the

effect of any unbalanced distributions would then be minimized.

Compared with the advantages listed above, this method has the following essential advantages:

a) the quality of the load distribution of messages having 5-bit SLS values essentially corresponds to that of messages having 8-bit SLS values

b) all messages coming from an STP equipped with this function use 8-bit SLS values

c) if this function is used sufficiently widely in an SS7 network, administration of whether a signaling point is using 5-bit or 8-bit SLS values only becomes necessary for nodes connected directly to an STP

d) even if the administration data are not up to date (i.e. if nodes originating messages are still identified as 5-bit SLS nodes even though they are already using 8-bit SLS values) or administration were dispensed with altogether, for instance after introduction of the method according to the invention (i.e. it would be assumed generally that 8-bit SLS values are used) this does not present a problem since the extra three bits would only be changed by the present invention and their distribution would thus become better, at most, with a suitable choice of function, although the advantageous 8-bit load distribution is used.

4. An inventive step consists of it being possible to expand messages having only 5-bit SLS values, which are received in signaling points with STP functions, to 8-bit SLS values.

5. One possible execution of the function is e.g. the exclusive OR operation on the three least significant bits of OPC and DPC and the insertion of the result into the SLS field of the relevant messages (see figure 3). The exclusive OR operation makes the variability of

the function independent of whether it takes place close to the destination (greater variability of the OPC) or close to the origin (greater variability of the DPC).

In a further instance of the example, the three bits generated from OPC and DPC are also logically combined with the three bits, which may not have been set, of the SLS field of the received message - e.g. again by means of an XOR function (see figure 4). A special characteristic of the XOR operation described is that when the received three bits are already set and thus vary in the received messages, the three bits sent by the function described vary at least as well in the messages sent, assuming that OPC and DPC of SLS value [lacuna]

Attachment:

Method for load distribution

1. What is the technical problem which is to be solved by your invention?

2. How has this problem been solved previously?

3. In what manner does your invention solve the technical problem specified (indicate advantages)?

4. What does an inventive step consists of?

5. Exemplary embodiment(s) of the invention.

1. Uniformity of the load distribution to the individual links of a link set in the MTP of the ZGS7. Among other things, uniformity is required since link-set-related congestion control methods are used in the MTP and the link with the greatest loading may trigger these controls and thus impedes or renders impossible higher utilization of the capacity of the other links.

2. Hitherto, the 4 bits (according to ITU) or 5 or 8 bits (according to ANSI) of the SLS (signaling link selection) field have been used for the load distribution. Both ITU and ANSI assume that the possible SLS values are statistically (approximately) uniformly distributed, which has to be ensured by the users of the MTP. In the case of the ITU, this only provides for a distribution into sixteen parts of the total traffic. As can be easily seen, when traffic is otherwise the same e.g. the link with the greatest loading in a link set with 5 links will thus be loaded as much as that in a link set having only 4 links, the

link set with 5 links will thus have no higher capacity which can be used than a link set having only 4 links, the traffic being otherwise identical. The ANSI solutions with an SLS length of 5 or 8 bits, respectively, have considerable advantages, therefore, but cannot be used in ITU-oriented MTP networks because of the different message formats and could only be used if the entire MTP network affected (including all implementations of the MTP and its users) were converted, which, in practice, is not possible.

3. In addition to the SLS field, the present invention also uses the address fields (OPC - originating point code and, respectively, DPC - destination point code) of the MTP messages for load distribution in that a function generates from the OPC and/or DPC a number of additional bits which, together with the SLS field, are used for load distribution. The function used can depend on the position of the respective node in the MTP network, on the numbering strategy used by the MTP network operator, or also on the granularity of the load distribution desired by him.

4. An essential inventive step consist in that an improvement of the load distribution can be achieved locally, where required (i.e., for example in a single node, for instance in an STP - signaling transfer point) without interworking or compatibility problems and without expenses for changes for the MTP users by using pre-existing information (i.e. the address information) which has the necessary variability with the exception of purely associated traffic relations. Another essential step lies in the (possible) combination of OPC and DPC for increasing the variability of the assumed values.

5. One possible way of performing the function is, e.g., the exclusive OR operation on the two least significant bits of OPC and DPC. In the ideal case, this results in a granularity of the load distribution of 64ths. The exclusive OR operation makes the variability of the function independent of whether it occurs close to the destination (greater variability of the OPC) or close to the origin (greater variability of the DPC).

Patent Claims

1. A signaling point which processes messages, among other things for forwarding, the messages exhibiting
   - an address field which is used by the signaling point for determining the next signaling point to which it will forward a message, and
   - an SLS field which is used by the signaling point for determining the links via which it forwards the message to the next signaling point, the SLS field exhibiting a particular number of bits and the signaling point using all bits for selecting the said link, whereas some other signaling points only use a particular subset of these bits for selecting the said link, characterized in that

   in the case of a received message to be forwarded, it establishes the SLS value and thus the link via which it will forward it by taking over the particular subset of bits of the received SLS field for the SLS field to be sent and generates the remaining bits of the SLS field to be sent with the aid of a function.

2. The signaling point as claimed in claim 1, characterized in that the said function uses the OPC and/or DPC for generating the said remaining bits.

3. The signaling point as claimed in claim 1 or 2, characterized in that the said function depends on the position of the respective signaling point in the signaling network, on the numbering strategy used by the signaling network operator, or also on the granularity of the load distribution desired by him.

4. Signaling point as claimed in one of claims 1 to 3, characterized in that the MTP of the signaling point distributes the SLS values generated by a user of the MTP to the links of a link set on the basis of a correlation which is selected in such a manner that the distribution is as equivalent as possible independently of whether an SLS value generated by the user comprises all bits of the SLS field or only the said subset.

5. The signaling node as claimed in one of claims 1 to 4, characterized in that it only uses the said function with a message with a subset SLS value, detecting such a message on the basis of corresponding administrative data at the link via which it arrives.

6. The signaling node as claimed in one of claims 2 to 5, characterized in that the said function additionally uses the bits of the received SLS field which are not contained in the particular subset for generating the remaining bits of the SLS field to be sent.

7. The signaling node as claimed in claim 6, characterized in that the said function is selected in such a manner that, with a statistical independence of the remaining bits of the received SLS value of the received OPC and DPC values, the generated remaining bits of the SLS field vary at least as well in the messages sent as in the messages received.

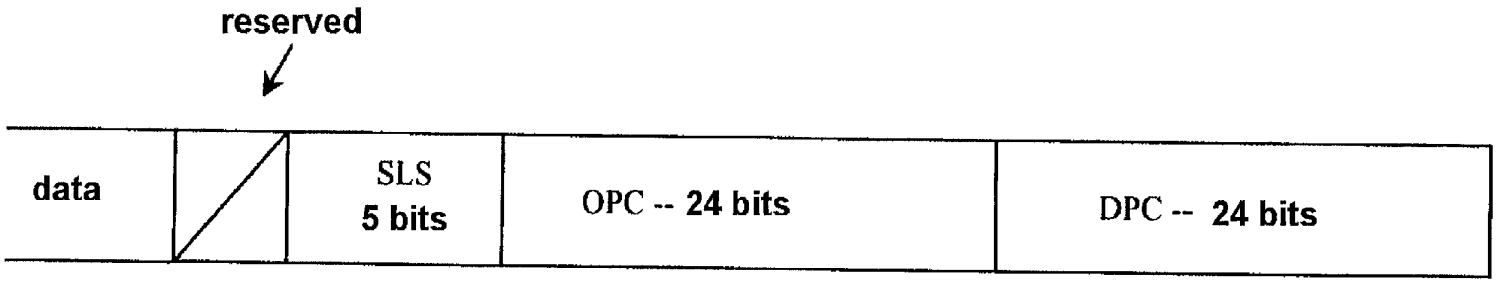

Abb. 1a) MSU format according to ANSI T1.111.4, 1991

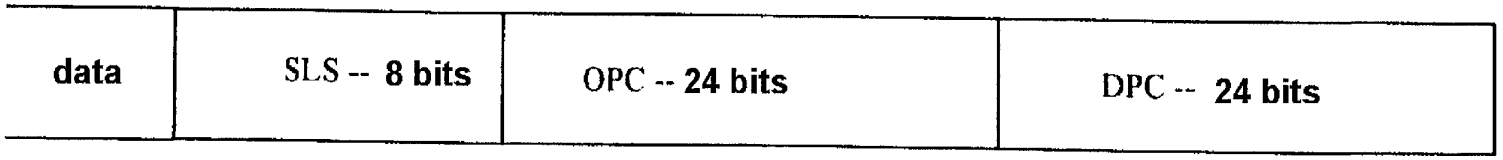

Abb. 1b) MSU format according to ANS T1.111.4, 1996

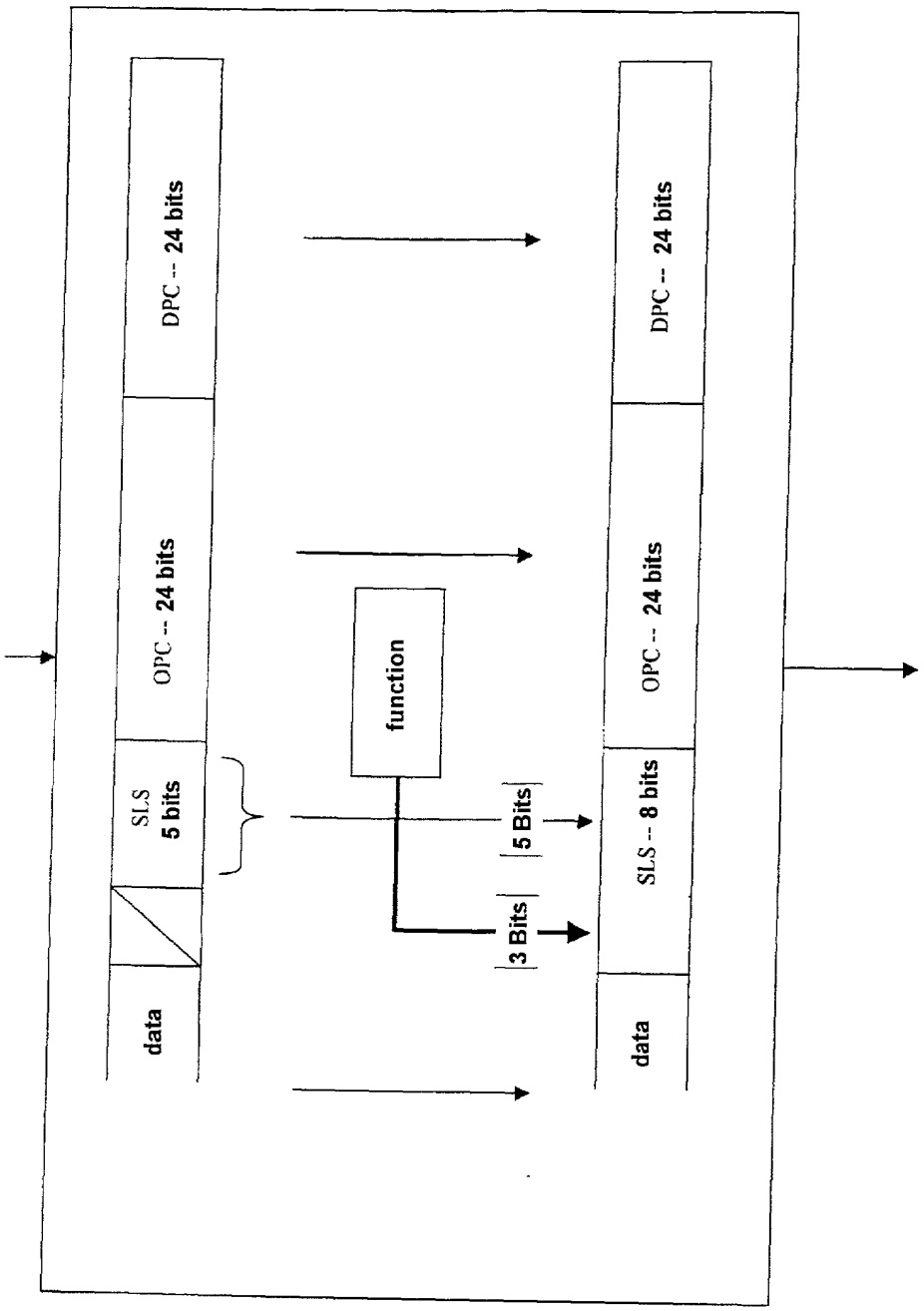
DPC -- 24 bits
OPC -- 24 bits
SLS
5 bits
data
function
5 Bits
3 Bits
DPC -- 24 bits
OPC -- 24 bits
SLS -- 8 bits
data

Figure 2

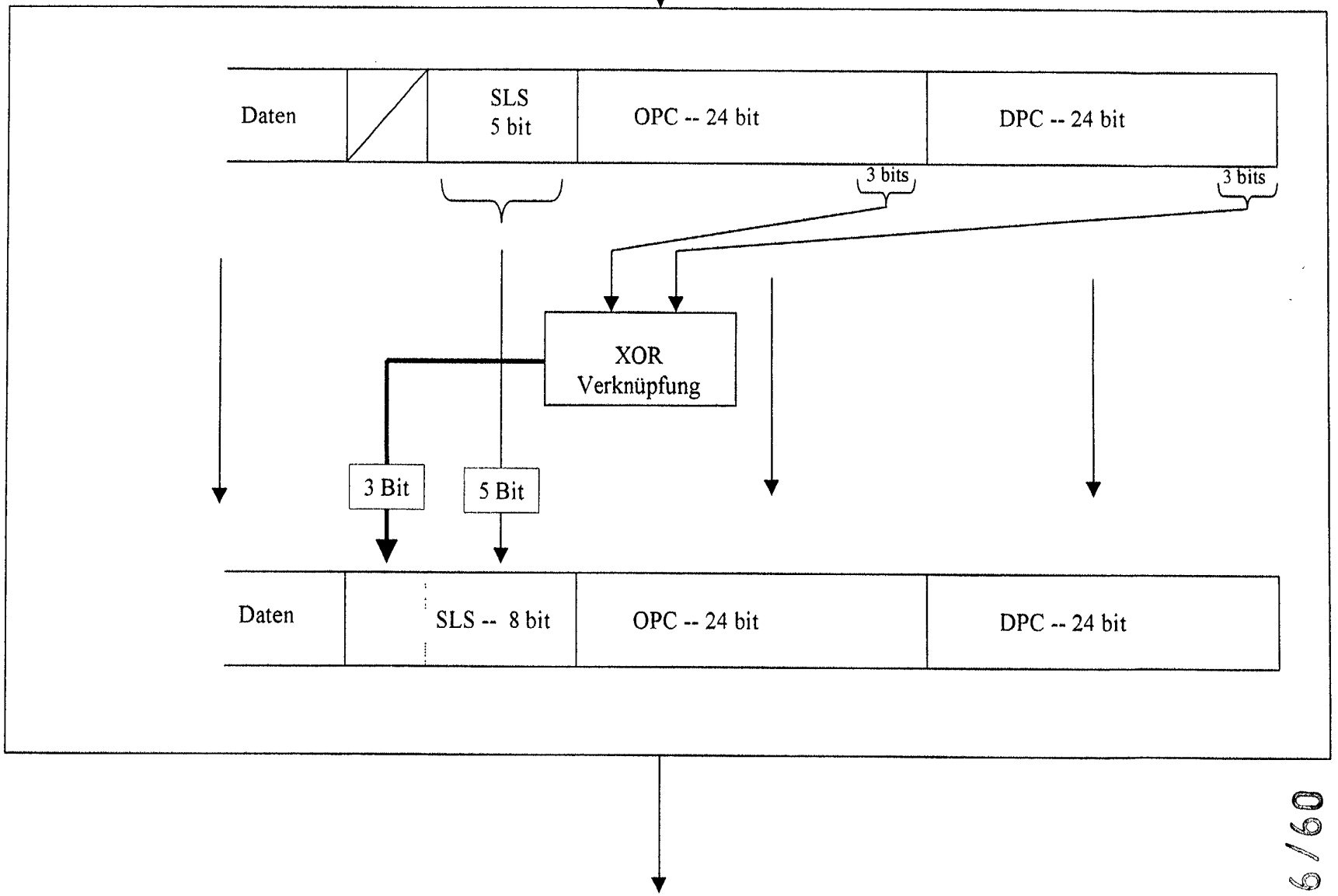

Figure 3

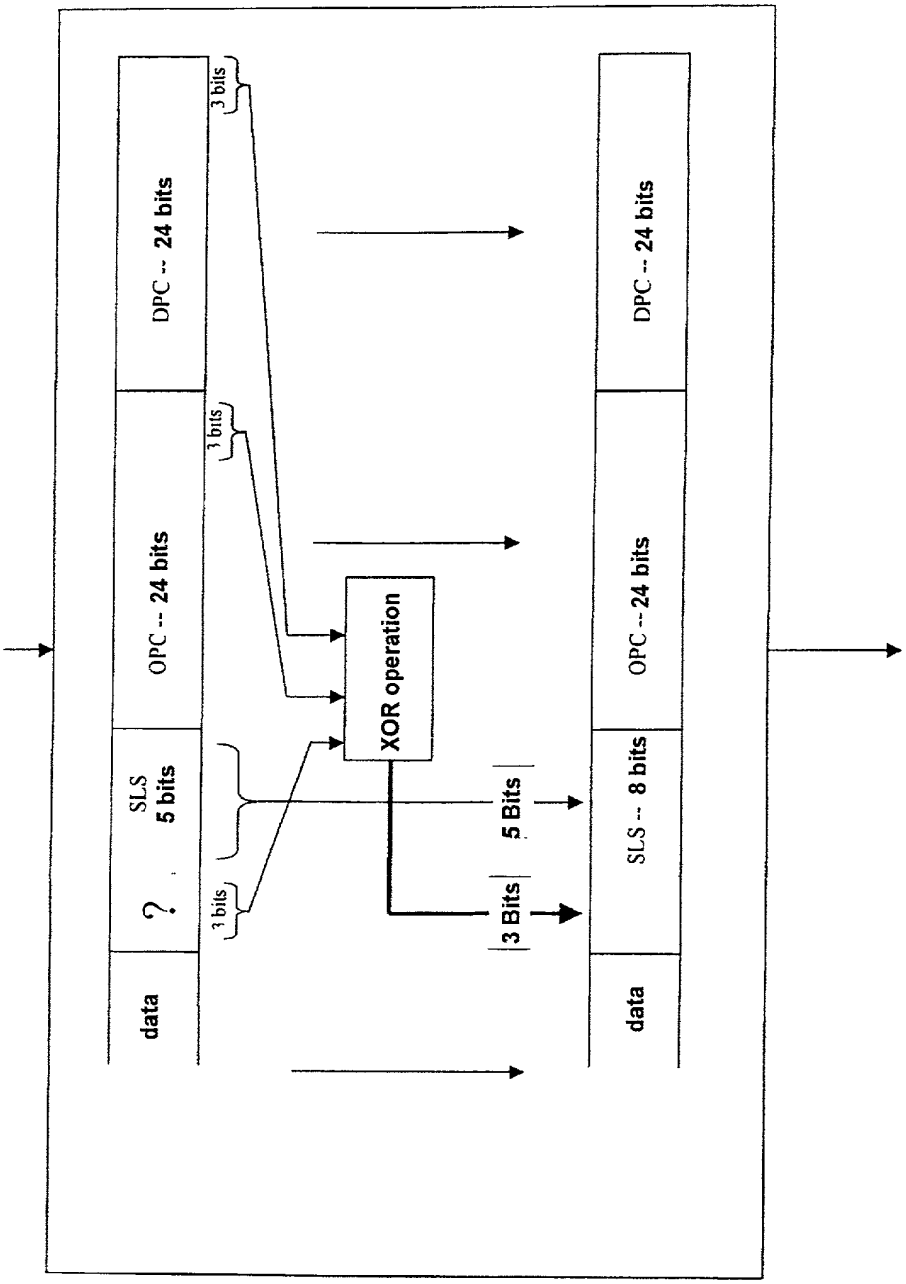
DPC -- 24 bits
OPC -- 24 bits
SLS
5 bits
?
data
3 bits
3 bits
3 bits
XOR operation
5 Bits
3 Bits
DPC -- 24 bits
OPC -- 24 bits
SLS -- 8 bits
data

Figure 4

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

My residence, post office address and citizenship are as stated below next to my name,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Signalisierungspunkt

Signaling point

deren Beschreibung

the specification of which

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am 17.02.2000 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/DE00/00450
eingereicht wurde und am _____
abgeändert wurde (falls tatsächlich abgeändert).

(check one)
☐ is attached hereto.
☒ was filed on 17.02.2000 as
PCT international application
PCT Application No. PCT/DE00/00450
and was amended on _____
(if applicable)

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign appplications
Priorität beansprucht

			Priority Claimed	
19906812.7	DE	18.02.1999	☒	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein
			☐	☐
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	Yes Ja	No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/00450	17.02.2000	anhängig	pending
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D, M, Y) (Anmeldedatum T, M, J)	(Status) (patentiert, anhängig, aufgegeben)	(Status) (patented, pending, abandoned)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	(Status) (patentiert, anhängig, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefahrden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

And I hereby appoint

Customer No.

Telefongespräche bitte richten an: *(Name und Telefonnummer)*

Direct Telephone Calls to: *(name and telephone number)*

Ext. _____

Postanschrift:

Send Correspondence to:

Bell, Boyd & Lloyd LLC
Three First National Plaza, 70 West Madison Street, Suite 3300 60602-4207 Chicago, Illinois
Telephone: (001) 312 372 11 21 and Facsimile (001) 312 372 20 98
or
Customer No.

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor:
KLAUS DAVID GRADISCHNIG	KLAUS DAVID GRADISCHNIG
Unterschrift des Erfinders Datum	Inventor's signature Date
10. May 01	10. May 2001
Wohnsitz	Residence
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Staatsangehörigkeit	Citizenship
AT	AT
Postanschrift	Post Office Addess
1714 Abercromby Court, Apt. D	1714 Abercromby Court, Apt. D
Reston, VA 20190 UNITED STATES OF AMERICA	Reston, VA 20190 UNITED STATES OF AMERICA
Voller Name des zweiten Miterfinders *(falls zutreffend)*:	Full name of second joint inventor, if any:
Unterschrift des Erfinders Datum	Second Inventor's signature Date
Wohnsitz ,	Residence ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).